

C

$$I(J^P) = 0(\frac{1}{2}^+)$$

Charge = $\frac{2}{3} e$ Charm = +1

c-QUARK MASS

The c -quark mass corresponds to the “running” mass m_c ($\mu = m_c$) in the $\overline{\text{MS}}$ scheme. We have converted masses in other schemes to the $\overline{\text{MS}}$ scheme using two-loop QCD perturbation theory with $\alpha_s(\mu=m_c) = 0.38 \pm 0.03$. The value 1.275 ± 0.025 GeV for the $\overline{\text{MS}}$ mass corresponds to 1.67 ± 0.07 GeV for the pole mass (see the “Note on Quark Masses”).

VALUE (GeV)	DOCUMENT ID	TECN	COMMENT
1.275±0.025 OUR EVALUATION	See the ideogram below.		
1.24 ± 0.03 $^{+0.03}_{-0.07}$	1 ALEKHIN	13 THEO	$\overline{\text{MS}}$ scheme
1.286 ± 0.066	2 NARISON	13 THEO	$\overline{\text{MS}}$ scheme
1.36 ± 0.04 ± 0.10	3 ALEKHIN	12 THEO	$\overline{\text{MS}}$ scheme
1.261 ± 0.016	4 NARISON	12A THEO	$\overline{\text{MS}}$ scheme
1.278 ± 0.009	5 BODENSTEIN	11 THEO	$\overline{\text{MS}}$ scheme
1.28 $^{+0.07}_{-0.06}$	6 LASCHKA	11 THEO	$\overline{\text{MS}}$ scheme
1.196 ± 0.059 ± 0.050	7 AUBERT	10A BABR	$\overline{\text{MS}}$ scheme
1.28 ± 0.04	8 BLOSSIER	10 LATT	$\overline{\text{MS}}$ scheme
1.273 ± 0.006	9 MCNEILE	10 LATT	$\overline{\text{MS}}$ scheme
1.279 ± 0.013	10 CHETYRKIN	09 THEO	$\overline{\text{MS}}$ scheme
1.25 ± 0.04	11 SIGNER	09 THEO	$\overline{\text{MS}}$ scheme
1.295 ± 0.015	12 BOUGHEZAL	06 THEO	$\overline{\text{MS}}$ scheme
1.24 ± 0.09	13 BUCHMULLER	06 THEO	$\overline{\text{MS}}$ scheme
1.224 ± 0.017 ± 0.054	14 HOANG	06 THEO	$\overline{\text{MS}}$ scheme
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.01 ± 0.09 ± 0.03	15 ALEKHIN	11 THEO	$\overline{\text{MS}}$ scheme
1.299 ± 0.026	16 BODENSTEIN	10 THEO	$\overline{\text{MS}}$ scheme
1.261 ± 0.018	17 NARISON	10 THEO	$\overline{\text{MS}}$ scheme
1.268 ± 0.009	18 ALLISON	08 LATT	$\overline{\text{MS}}$ scheme
1.286 ± 0.013	19 KUHN	07 THEO	$\overline{\text{MS}}$ scheme
1.33 ± 0.10	20 AUBERT	04X THEO	$\overline{\text{MS}}$ scheme
1.29 ± 0.07	21 HOANG	04 THEO	$\overline{\text{MS}}$ scheme
1.319 ± 0.028	22 DEDIVITIIS	03 LATT	$\overline{\text{MS}}$ scheme
1.19 ± 0.11	23 EIDEMULLER	03 THEO	$\overline{\text{MS}}$ scheme
1.289 ± 0.043	24 ERLER	03 THEO	$\overline{\text{MS}}$ scheme
1.26 ± 0.02	25 ZYABLYUK	03 THEO	$\overline{\text{MS}}$ scheme
1 ALEKHIN 13 determines m_c from charm production in deep inelastic scattering at HERA using approximate NNLO QCD.			
2 NARISON 13 determines m_c using QCD spectral sum rules to NNLO and including condensates up to dimension 6.			
3 ALEKHIN 12 determines m_c from heavy quark production in deep inelastic scattering at HERA using approximate NNLO QCD.			
4 NARISON 12A determines m_c using sum rules for the vector current correlator to order α_s^3 , including the effect of gluon condensates up to dimension eight.			
5 BODENSTEIN 11 determine $\bar{m}_c(3 \text{ GeV}) = 0.987 \pm 0.009$ GeV and $\bar{m}_c(\bar{m}_c) = 1.278 \pm 0.009$ GeV using QCD sum rules for the charm quark vector current correlator.			
6 LASCHKA 11 determine the c mass from the charmonium spectrum. The theoretical computation uses the heavy $Q\bar{Q}$ potential to order $1/m_Q$ obtained by matching the short-distance perturbative result onto lattice QCD result at larger scales.			
7 AUBERT 10A determine the b - and c -quark masses from a fit to the inclusive decay spectra in semileptonic B decays in the kinetic scheme (and convert it to the $\overline{\text{MS}}$ scheme).			
8 BLOSSIER 10 determines quark masses from a computation of the hadron spectrum using $N_f=2$ dynamical twisted-mass Wilson fermions.			
9 MCNEILE 10 determines m_c by comparing four-loop perturbative results for the pseudo-scalar current to lattice simulations with $N_f = 2+1$ sea-quarks by the HPQCD collaboration.			
10 CHETYRKIN 09 determine m_c and m_b from the $e^+e^- \rightarrow Q\bar{Q}$ cross-section and sum rules, using a four-loop computation of the heavy quark vacuum polarization. They also determine $m_c(3 \text{ GeV}) = 0.986 \pm 0.013$ GeV.			
11 SIGNER 09 determines the c -quark mass using non-relativistic sum rules to analyze the $e^+e^- \rightarrow c\bar{c}$ cross-section near threshold. Also determine the PS mass $m_{PS}(\mu_F=0.7 \text{ GeV}) = 1.50 \pm 0.04$ GeV.			
12 BOUGHEZAL 06 result comes from the first moment of the hadronic production cross-section to order α_s^3 .			

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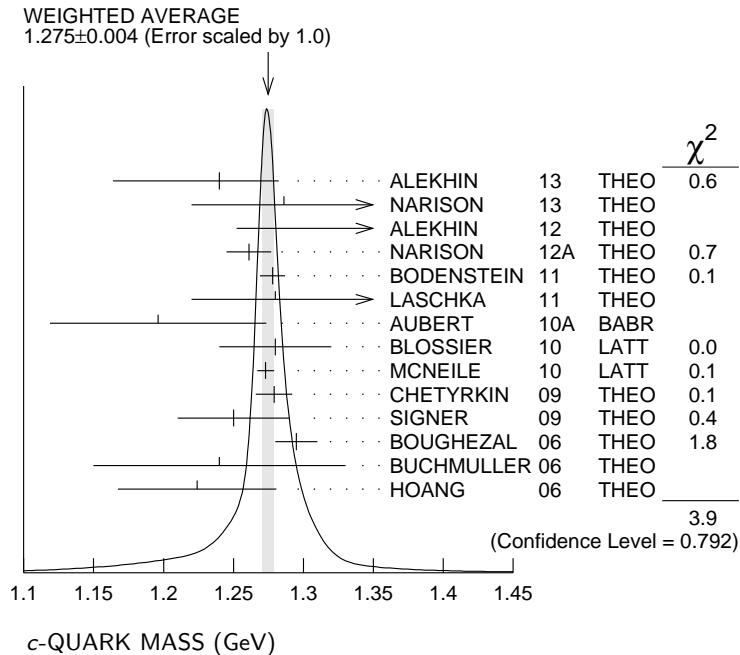
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- 13 BUCHMULLER 06 determine m_b and m_c by a global fit to inclusive B decay spectra.
- 14 HOANG 06 determines $\bar{m}_c(\bar{m}_c)$ from a global fit to inclusive B decay data. The B decay distributions were computed to order $\alpha_s^2 \beta_0$, and the conversion between different m_c mass schemes to order α_s^3 .
- 15 ALEKHIN 11 determines m_c from heavy quark production in deep inelastic scattering using fixed target and HERA data, and approximate NNLO QCD.
- 16 BODENSTEIN 10 determines $\bar{m}_c(3 \text{ GeV}) = 1.008 \pm 0.026 \text{ GeV}$ using finite energy sum rules for the vector current correlator. The authors have converted this to $\bar{m}_c(\bar{m}_c)$ using $\alpha_s(M_Z) = 0.1189 \pm 0.0020$.
- 17 NARISON 10 determines m_c from ratios of moments of vector current correlators computed to order α_s^3 and including the dimension-six gluon condensate.
- 18 ALLISON 08 determine m_c by comparing four-loop perturbative results for the pseudo-scalar current correlator to lattice simulations by the HPQCD collaboration. The result has been updated in MCNEILE 10.
- 19 KUHN 07 determine $\bar{m}_c(\mu = 3 \text{ GeV}) = 0.986 \pm 0.013 \text{ GeV}$ and $\bar{m}_c(\bar{m}_c)$ from a four-loop sum-rule computation of the cross-section for $e^+ e^- \rightarrow \text{hadrons}$ in the charm threshold region.
- 20 AUBERT 04X obtain m_c from a fit to the hadron mass and lepton energy distributions in semileptonic B decay. The paper quotes values in the kinetic scheme. The $\overline{\text{MS}}$ value has been provided by the BABAR collaboration.
- 21 HOANG 04 determines $\bar{m}_c(\bar{m}_c)$ from moments at order α_s^2 of the charm production cross-section in $e^+ e^-$ annihilation.
- 22 DEDIVITIIS 03 use a quenched lattice computation of heavy-heavy and heavy-light meson masses.
- 23 EIDEMULLER 03 determines m_b and m_c using QCD sum rules.
- 24 ERLER 03 determines m_b and m_c using QCD sum rules. Includes recent BES data.
- 25 ZYABLYUK 03 determines m_c by using QCD sum rules in the pseudoscalar channel and comparing with the η_c mass.



m_c/m_s MASS RATIO

VALUE

11.81±0.14 OUR AVERAGE

DOCUMENT ID

TECN

Error includes scale factor of 1.1. See the ideogram below.

$11.27 \pm 0.30 \pm 0.26$

26 DURR 12 LATT

12.0 ± 0.3

27 BLOSSIER 10 LATT

11.85 ± 0.16

28 DAVIES 10 LATT

26 DURR 12 determine m_c/m_s using a lattice computation with $N_f = 2$ dynamical fermions. The result is combined with other determinations of m_c to obtain $m_s(2 \text{ GeV}) = 97.0 \pm 2.6 \pm 2.5 \text{ MeV}$.

27 BLOSSIER 10 determine m_c/m_s from a computation of the hadron spectrum using $N_f = 2$ dynamical twisted-mass Wilson fermions.

28 DAVIES 10 determine m_c/m_s from meson masses calculated on gluon fields including u , d , and s sea quarks with lattice spacing down to 0.045 fm. The Highly Improved Staggered quark formalism is used for the valence quarks.

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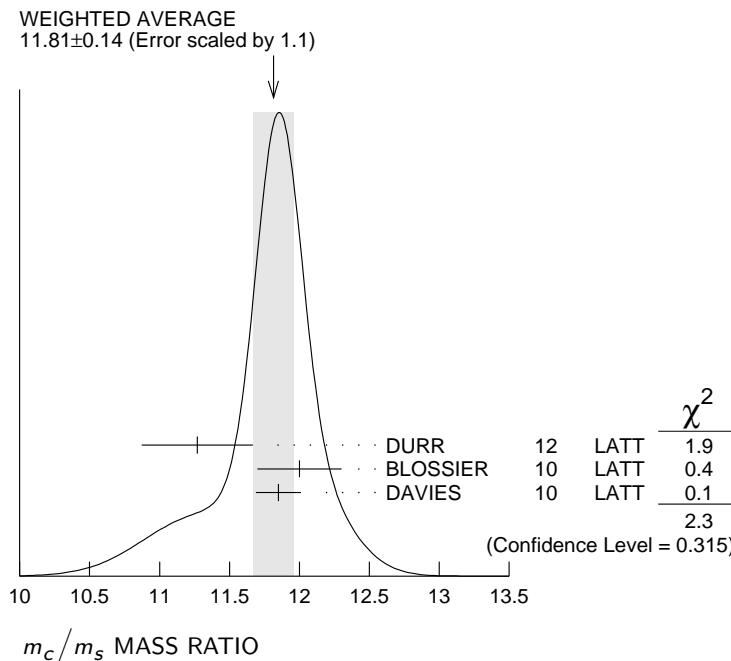
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$m_b - m_c$ QUARK MASS DIFFERENCE

VALUE (GeV) DOCUMENT ID TECHN

3.45 ±0.05 OUR EVALUATION

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.472±0.032	29	AUBERT	10A	BABR
3.42 ±0.06	30	ABDALLAH	06B	DLPH
3.44 ±0.03	31	AUBERT	04X	BABR
3.41 ±0.01	31	BAUER	04	THEO

29 AUBERT 10A determine the b - and c -quark masses from a fit to the inclusive decay spectra in semileptonic B decays in the kinetic scheme.

30 ABDALLAH 06B determine $m_b - m_c$ from moments of the hadron invariant mass and lepton energy spectra in semileptonic inclusive B decays.

31 Determine $m_b - m_c$ from a global fit to inclusive B decay spectra.

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REFID=49991
REFID=50494
REFID=50106
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c-QUARK REFERENCES

ALEKHIN	13	PL B720 172	S. Alekhin <i>et al.</i>	(SERP, DESYZ, WUPP+)
NARISON	13	PL B718 1321	S. Narison	(MONP)
ALEKHIN	12	PL B718 550	S. Alekhin <i>et al.</i>	(SERP, WUPP, DESY+)
DURR	12	PRL 108 122003	S. Durr, G. Koutsou	(WUPP, JULI, CYPR)
NARISON	12A	PL B706 412	S. Narison	(MONP)
ALEKHIN	11	PL B699 345	S. Alekhin, S. Moch	(DESY, SERP)
BODENSTEIN	11	PR D83 074014	S. Bodenstein <i>et al.</i>	
LASCHKA	11	PR D83 094002	A. Laschka, N. Kaiser, W. Weise	
AUBERT	10A	PR D81 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)
BLOSSIER	10	PR D82 114513	B. Blossier <i>et al.</i>	(ETM Collab.)
BODENSTEIN	10	PR D82 114013	S. Bodenstein <i>et al.</i>	
DAVIES	10	PRL 104 132003	C.T.H. Davies <i>et al.</i>	(HPQCD Collab.)
MCNEILE	10	PR D82 034512	C. McNeile <i>et al.</i>	(HPQCD Collab.)
NARISON	10	PL B693 559	S. Narison	(MONP)
Also		PL B705 544 (<i>errat.</i>)	S. Narison	(MONP)
CHEYTRKIN	09	PR D80 074010	K.G. Chetyrkin <i>et al.</i>	(KARL, BNL)
SIGNER	09	PL B672 333	A. Signer	(DURH)
ALLISON	08	PR D78 054513	I. Allison <i>et al.</i>	(HQCD Collab.)
KUHN	07	NP B778 192	J.H. Kuhn, M. Steinhauser, C. Sturm	
ABDALLAH	06B	EPJ C45 35	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
BOUGHEZAL	06	PR D74 074006	R. Boughezal, M. Czakon, T. Schutzmeier	
BUCHMULLER	06	PR D73 073008	O.L. Buchmuller, H.U. Flacher	(RHBL)
HOANG	06	PL B633 526	A.H. Hoang, A.V. Manohar	
AUBERT	04X	PRL 93 011803	B. Aubert <i>et al.</i>	(BABAR Collab.)
BAUER	04	PR D70 094017	C. Bauer <i>et al.</i>	
HOANG	04	PL B594 127	A.H. Hoang, M. Jamin	
DEDIVITIS	03	NP B675 309	G.M. de Divitiis <i>et al.</i>	
EIDEMULLER	03	PR D67 113002	M. Eidemuller	
ERLER	03	PL B558 125	J. Erler, M. Luo	
ZYABLYUK	03	JHEP 0301 081	K.N. Zyablyuk	(ITEP)